Clinical Nutrition ESPEN xxx (2016) 1–6

Contents lists available at ScienceDirect

Clinical Nutrition ESPEN

journal homepage: http://www.clinicalnutritionespen.com

Original article

Handgrip strength and weight predict long-term mortality in acute kidney injury patients

S.P. Xavier*, C.R. Goes, M.N.B. Bufarah, A.L. Balbi, D. Ponce

Botucatu School of Medicine, UNESP, Brazil

A R T I C L E I N F O

Article history:
Received 7 July 2015
Accepted 30 September 2016

Keywords:
Acute kidney injury
Long-outcome
Mortality
Predictors
Handgrip strength
Weight

S U M M A R Y

Introduction: Surviving acute kidney (AKI) patients have a higher late mortality compared with those admitted without AKI. The negative impact of malnutrition on the early outcome of AKI patients has recently been confirmed by various studies. However, its impact after hospital discharge has not been studied. The objective of the study was to determine the role of anthropometric measurements and handgrip strength as predictors of mortality 180 days after discharge.

Methodology: Eighty-two survivors AKI patients who were older than 18 y old and followed by AKI team were prospectively evaluated. Patient's characteristics were recorded, anthropometric measurements were taken, handgrip strength (HGS) was measured, subjective global assessment and bioimpedance were applied and blood samples were collected during hospitalization at first and last nephrologist evaluation and in after hospital discharge at 1 month, 3 and 6 months. Multivariable logistic regression was used to adjust confounding and selection bias.

Results: Age was 62.3 ± 14.7 years, prevalence of hospitalization in medical wards of 71.6%, index of severity of AKI (ATN-ISS) was 28% and late mortality rates was 25.6%. Risk factors associated with late mortality were the number of comorbidities (HR = 1.79, 95% CI = 1.45–2.46, p = 0.04), cancer (HR = 1.89, 95 CI% = 1.48–3.16, p = 0.01), sepsis (HR = 1.47, 95% CI = 1.18–2.38, p = 0.03), no recovery of renal function at hospital discharge (HR = 1.46, 95% CI = 1.02–2.16, p = 0.03), malnutrition at first evaluation (HR = 1.58, 95% CI = 1.14–2.94, p = 001), the HGS value at the moment of last evaluation by nephrologist (HR = 1.81, 95% CI = 1.17–2.31, p = 0.04) and gain weigh < 1 kg between the moment at first evaluation by nephrologist and one month after hospital discharge (HR = 1.95, 95 CI% = 1.29–3.3, p = 0.02).

Conclusion: HGS and gain weight were identified as predictors of late mortality. Simple and ease methods can be applied in AKI patients during and after hospitalization to diagnose nutritionally patients who are at higher risk for poor prognosis and, consequently intervention measures can be performed to improve survival in long-term.

1. Introduction

Traditionally, most studies on AKI have focused on short-term outcomes often assessed at hospital discharge. However, recent studies have claimed that long-term outcome of patients after an AKI episode is also poor, ranged from 15% to 74% [1–5].

Nutritional status is condition that significantly contributes to an increased in-hospital mortality rate of these patients [6–9]. Fiaccadori et al. [6] assessed 309 AKI patients and identified association between severe malnutrition and unfavorable prognosis. A retrospective study by Obialo et al. [7] showed association of values below 3.5 g/dL of albumin and mortality in AKI patients. Berbel et al. [8] showed that low caloric intake, higher CRP levels, presence of oedema, lower resistance by bioelectrical impedance and lower nitrogen balance were significantly associated with higher risk of in-hospital death in AKI patients.

Although it is known that nutritional status can have impact on clinical outcomes, few studies have previously addressed the association of the nutritional markers and long-term outcome. Hospitalized patients with pneumonia were evaluated by Vecchiarino et al. [10] at admission and 30 days after hospital discharge and malnutrition and HGS lower than 10 kg were associated with longer hospital stay, hospital readmission and death.

* Corresponding author.
E-mail address: pati_xavierr@hotmail.com (S.P. Xavier).

http://dx.doi.org/10.1016/j.clnesp.2016.09.006
2405-4577/

Kvale et al. [11] assessed critically ill patients seven months after intensive care unit (ICU) discharge and showed that the body weight at the follow-up consultation compared with that before the ICU stay was lower in 50% of patients, which shows a persistent worsening of the nutritional status even after several months of hospital discharge and it may contribute to the poor prognosis of patients.

Considering the lack of information about association of the nutritional markers with long-term mortality after AKI episode, the objective of this study was to analyze the role of anthropometric measurements and handgrip strength as predictors of mortality in AKI patients 180 days after hospital discharge.

2. Patients and methods

All procedures were approved by the ethics committee of our institution, and all participants gave their written consent.

2.1. Study design

This was a prospective cohort study performed at a single center with AKI patients who were followed by nephrology and nutrition during hospitalization in Botucatu School of Medicine, University of Sao Paulo State, Brazil, from October 2012 to May 2014. Inclusion criteria were individuals who had a diagnosis of acute tubular necrosis (ATN) and lived for at least 30 days after hospital discharged. We excluded individuals younger than 18 years, with other etiologies of AKI, with CKD stages 4 and 5, receipt of a kidney transplant or any form of dialysis in the 5-year period preceding the index hospitalization. AKI patients discharged alive were followed by the same nephrologist and nutritionist for at least six months. The follow up was every three months during the first year, every six months in the second year and then annually thereafter.

The diagnosis of AKI was defined according to serum creatinine levels, as proposed by the KDOQI – Acute Kidney Injury [12]. ATN was diagnosed as a history of prolonged and profound hypotension, severe nephrotoxic drug overdose, or excess endogenous nephrotoxic pigments (hemoglobinuria, myoglobinuria). Diagnosis was based on clinical history, results of physical examination, relevant blood tests, urinalysis (microscopic examination of urinary sediment), a fractional excretion of sodium that exceeded 1%, and the findings on renal ultrasonography [3].

For sample size estimation, the Fisher–Belle formula was used, with the following variables: 30% long-term mortality prevalence in AKI patients, 95% confidence interval (CI), and 10% sample error [13]. The result was 82 patients.

Variables recorded during AKI admission were sex, age, comorbid conditions (cardiac, hepatic and tumours, diabetes mellitus, hypertension and CKD), intensive care unit (ICU) admission, ATN etiology (ischemic, nephrotoxic or mixed), Scr levels (baseline, at the moment of AKI diagnosis, the highest value during admission and at discharge), and the need for dialysis. Recovery of renal function (RF) at hospital discharge was assessed by the ratio between the discharge and the reference GFR (diacharge GFR/reference GFR) and classified as complete if >0.9; partial if <0.9 and >0.5 and absent if <0.5 [4].

Acute Tubular Necrosis-Index Severity Score (ATN-ISS) was calculated at the moment of AKI diagnosis [21]. Nutritional Assessment Protocol was composed by SGA (Subjective Global Assessment), biochemical parameters (C-reactive protein, albumin, hemoglobin, cholesterol, total lymphocyte count, phosphorus and potassium), anthropometry, bioelectrical impedance analysis (BIA) and handgrip strength. BIA and functional and anthropometric data were collected in two moments during hospitalization (at first and last nephrologist evaluation) and in three moments after hospital discharge (at 1 month, 3 and 6 months). All survivors patients were evaluated 30, 90 and 180 days after hospital discharge.

Informed written consent was obtained from each individual included in our study. The study was approved by the research ethics board of Botucatu School of Medicine on November 2012.

2.2. Anthropometric measurements

Mobile patients were weighed on a digital scale (Plenna, Wind, Brazil) and weight of immobilised patients was obtained using abed scale. The weight "dry" was estimated using the Martins table [14] that evaluates the weight "dry" according to the intensity of edema. The height was measured with a portable stadiometer (Taylor®, Brazil), to the nearest 0,1 cm.

BMI was determined by the standard formula dry weight (kg)/ height 2 (m). Nutritional status was classified according to the percentage of their weight [15].

The nutritional status was assessed according with on Subjective Global Assessment proposed by Detsky et al., which classifies the patient in well nourished (SGA class A), moderately malnourished (SGA class B) or severely malnourished (SGA class C) [16].

2.3. Bioelectrical impedance analysis

BIA was performed using the single frequency equipment *(Biodynamics®, model 450, 800 μA, 50 KHz)* It provided results including reactance (ohms), phase angle (°), and extracellular water (%). The measurements were performed with the patient in the supine position. In patients treated by haemodialysis, it was performed 30 min after the end of the session.

2.4. Handgrip strength measurement

HGS was evaluated using a calibrated Jamar® Hydraulic Hand dynamometer (Sammons Preston, Bolingbrook, IL, USA). All measurements were performed for the non-dominant hand and where this is not possible the patients non dominant hand, with the patient sitting on a bed or chair in the posture found to produce the most accurate results [17], and a trained examiner administered all tests. The subjects performed three maximum attempts for each measurement, and the best performance of these tests was recorded. During testing, the participant was strongly encouraged to exhibit the best possible force. One-minute rests were given between each attempt to minimize fatigue effects [18].

2.5. Laboratory data analysis

Total serum levels of C-reactive protein, albumin, glucose, creatinine, and serum urea nitrogen were measured using the dry chemistry method (Ortho-Clinical Diagnostics VITROS 950, Johnson & Johnson, New Jersey, USA.). Hemograms were obtained with a Coulter STKS hematologic autoanalyzer (Luton/Bedfordshire, UK).

2.6. Statistical analysis

The data are expressed as mean_standard deviation or median (lower to upper quartile). Statistical comparisons between the groups for continuous variables were performed using Student's t test for parameters with normal distributions. Otherwise, comparisons between groups were conducted using the Mann–Whitney. The chi-square test was used for all categorical data. Logistic regression was used to predict late mortality. For the analysis of repeated measures, asymmetric distribution (gamma) under the GENMOD procedure was used. Handgrip strength and anthropometric measurements were tested as independent